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ABSTRACT

This paper focuses on the cultural aspects of research in mathematics learning. The shift to a more socio-cultural emphasis in mathematics education research is valid. The paper explores this point by examining challenges to the former research paradigm. These challenges include culturally-based mathematical knowledge and hidden values in teaching. (Contains 16 references.) (DDR)

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CRITICAL CHALLENGES IN RESEARCHING CULTURAL ISSUES IN MATHEMATICS LEARNING

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Introduction

I believe that the major developments in thinking about mathematics education in the last decade have come about through research initiatives, and also that research is where we must look for new ideas and developments (Bishop et al., 1996). The school curriculum in many countries is now so controlled by central authorities, local politicians, or commercial interests, that the opportunities for significant developments coming from teachers themselves are increasingly unlikely. This does not mean that teachers have nothing to contribute - far from it. Nor does it mean that researchers are always free to investigate whatever they wish. What it does mean is that we need to develop more collaborative research between practitioners and researchers in the future if we are to gain the full benefits of what each group can offer.

The focus of my paper will be on cultural aspects of research in mathematics learning, and I will situate my discussion within the research context of mathematics education generally. With the shift to a more socio-cultural emphasis in research that we have seen in the last 20 years has also come an awareness that the dominant research methods used earlier may not now be the most appropriate. I shall address later in the paper one of the ramifications of this point. However, to start with I wish to set the curriculum context.

The Challenge of Culturally-Based Mathematical Knowledge

One of the most significant areas of research development in the last two decades has been in ethnomathematics. It has not only generated a great deal of interesting evidence, but it has fundamentally changed many of our ideas and constructs. The most significant influences have been in relation to:

- human interactions. Ethnomathematics concerns mathematical activities and practices in society, which take place outside school, and it thereby draws attention to the roles which people other than teachers and learners play in mathematics education.
- values and beliefs. Ethnomathematics makes us realize that any mathematical activity involves values, beliefs and personal choices.
- interactions between mathematics and languages. Languages act as the

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principal carriers of mathematical ideas and values in different cultures.

- cultural roots. Ethnomathematics is making us more aware of the cultural starting points and histories of mathematical development.

In general, these points have forced us into giving more consideration of the overall structure of the mathematics curriculum and to how it responds, or more usually how it does not respond, to the challenge of culturally based knowledge. In general the mathematics curricula which exist in the countries of the world are not culturally responsive (see Bishop et al., 1993) but are remarkably similar. Whether these similarities exist by choice or are a result of various waves of cultural imperialism is not clear (see Bishop, 1990), but they certainly do not appear to reflect differences in cultural context.

The curriculum structures we generally see have evolved to suit the preparation of an elite minority of students who will study mathematics at university. However when we consider the majority of school pupils who either never go on to study more mathematics or who don't even go to university, this elitist mathematics education is highly inappropriate, and contributes significantly to the widespread problems of alienation felt by many students towards mathematics in particular and also towards schooling in general. Research therefore needs to explore how the mathematics curriculum can be made more culturally responsive, in order to encourage more participation at the higher levels particularly amongst cultural minority groups.

The Challenge of 'Hidden Values' in Teaching

Moving to another critical contextual aspect of learning, let us briefly consider teaching from the cultural perspective. Having already explored several aspects in other writings, (for example, Bishop, 1991) I would like here to concentrate on one often ignored aspect, which is that of values in mathematics teaching. In keeping with a common idea that many people still seem to have, that mathematics education is universal and culture-free, it is also perceived by them to be value-free. This does not mean that they think mathematics has no value, but rather that they do not think it has any values over and above those values a particular society is promoting.

I believe that it is significant that in curricular developments such as Science and Technology in Society the area of values is taken as serious curricular content. In mathematics curricula that is certainly not the case. Beliefs and values in mathematics education are not taken as 'knowledge' with a strong cognitive component, they are instead treated as affective aspects (see McLeod, 1992). What should be of greater concern to mathematics educators is that values teaching and learning does occur in mathematics classrooms, and because most of it appears from our preliminary studies to be done implicitly, there is only a limited understanding at present of what and how values are being transmitted. Given the often-quoted negative views expressed by

adults about their bad mathematics learning experiences, one could speculate that the values transmitted to them were not the ones that most educators or educational policy makers would think of as desirable, but that they were transmitted rather effectively!

Rarely does one find explicit values teaching going on in mathematics classrooms, and from our research, few mathematics teachers admit to explicit values teaching. It is however clear from Seah's (1999) research that textbooks do portray certain values, and in our research we are about to document what values teachers do portray. Thompson (1992) summarized the research on teacher beliefs, this time in relation to teachers' actions in the classroom. She points to a repeated finding that mathematics teachers' actions frequently bore no relation to their professed beliefs about mathematics and mathematics teaching. The research by Sosniak et al. (1991) also found striking inconsistencies between different belief statements given by the same teachers. Hence my use of the 'hidden values' words in the title of this section. Values in mathematics education appear to have the role of cultural 'hidden persuaders' (Bishop, 1990). I would contend that this discrepancy between beliefs and values is precisely why it is necessary to focus research on values rather than beliefs, in order to determine the deeper affective qualities that underpin teachers' preferred decisions and actions and that ultimately affect the learners' beliefs and values. My research colleague Phil Clarkson and I have coined a phrase to help us distinguish beliefs and hidden values: "Values are beliefs in action." What we are trying to capture with that phrase is the idea that teachers appear to hold several beliefs, which may or may not be consistent, but that the important transition from a belief into a value occurs in the context of the teacher's actions (see the Values and Mathematics Project web-site <http://www.education.monash.edu.au/projects/vamp>)

In summary then, the challenges for researching values in mathematics teaching include:

- To what extent does explicit values teaching occur in mathematics classrooms?
- Are teachers aware of the values they are transmitting, modelling or portraying?
- Is implicit values teaching more or less effective than explicit values teaching?
- How do teachers facilitate the transitions between implicit and explicit values learning?

Researching mathematics learning: meeting the challenge of culturally situated learning

The importance of the socio-cultural approach to research on learning is due to the fact that the cognitive psychological program, with its focus on individual cognition and intra-individual characterisations and explanations has tended to ignore the crucial socio-cultural context of mathematics learning. However, socio-cultural research in mathematics education has tended to focus on learning within certain cultural prac-

tices and communities, and thereby has failed to take into account two crucial aspects Firstly, the focus on inter-practice differences between cultural groups has obscured important inter-individual differences within those cultural groups. Secondly, the research has tended to ignore the transition aspects of learning between those cultural practices.

Particularly in diverse multicultural societies, we can see that the culture experienced by learners in their homes is rarely the same as that represented by the school curriculum. This kind of disjunction can easily lead to what I have called 'cultural conflicts' (Bishop, 1994). The construct of 'cultural conflict' grew out of educational research in the anthropological tradition. We can find it, for example, as a central idea in McDermott's (1974) classic chapter about 'pariah groups' whose children fail to succeed in mainstream schools. He builds on Barth's (1969) definition of pariah groups, who are those who are "actively rejected by the host population". According to McDermott, "Students and teachers in a pariah-host population mix usually produce communicative breakdowns by simply performing routine and practical everyday activities in ways their sub-cultures define as normal and appropriate....The problem is neither 'dumb kids' nor 'racist teachers', but cultural conflict" (p.173).

Thus for many children around the world the educative experience in schools is not culturally consonant with their home experience. Their situation is one of cultural dissonance and the educational process is one of acculturation, rather than enculturation. The social groupings in which learners exist and learn inside and outside school have their own cultures, customs, languages and values. This is the basis for the development of the research on 'situated cognition' (Lave and Wenger, 1991; Kirshner and Whitson, 1997). The study of the 'failures' of bilingual learners in a monolingual classroom, or of farmers' children studying in totally urban-centred curriculum, or of handicapped learners, all help to shed light on other explanations of failure and success besides the attributes of the learners themselves. However we must not fail to recognize the variation within these groups, and the fact that certain of the learners' attributes will be significant in enabling them, or not, to succeed in the culture of the classroom. Research needs to address those attributes in the socio-cultural context.

Equally more research needs to focus on the transitions in learning experienced by learners in cultural conflict situations (Abreu, Bishop and Presmeg, in press). The learners are clearly faced with negotiating transitions in knowledge, and knowing, but they must also make transitions in values, language customs and behaviours. What is it about learners who succeed with knowledge transitions, or what is it about their learning experiences? What effects do the teacher and other 'significant others' in the social context have on their successful transitions, or otherwise? Here Bronfrenbrenner's (1979) perspective on the ecology of human development is worth revisiting.

These perspectives enable us to see that learners are not just learning the cultural knowledge that they are being taught (as well as other knowledge that they are not

taught, of course). They are in fact co-constructing that knowledge. (Note that they are not re-constructing knowledge, since it can never be re-constructed to the same form.) This is to my mind the most important point about constructivism – not that it is the individual who is constructing her/his own personal knowledge. Of course from a psychological point of view that is important, but it is also rather obvious. What is much more important is what is the quality of the *social* situation that enables the learners to socially co-construct their new cultural knowledge. Knowledge changes with every generation, and it is mediated in that change by teachers and by learners of all cultural persuasions.

Thus the challenges for improving mathematics learning through research include:

- How best to represent the 'social situation' in situated cognition research in mathematics education?
- What distinguishes learners, and their contexts, who succeed in making mathematical knowledge transitions between contexts from those who do not?
- What distinguishes cultural constructivism from social constructivism?
- What implications for teaching does cultural construction have as a metaphor for education?
- How to research cultural transitions in mathematics learning?

What About our Research Approaches?

The essential goal of research in mathematics education is to help us understand phenomena in richer ways so that we can improve the teaching and learning situation for as many students as possible. But as we embrace fully the implications of a cultural perspective on mathematics learning, are our research methods and procedures themselves adequate for the task? There are several researchers who argue 'no', and that we need to change how research is carried out and conceptualised if we are to address these socio-cultural aspects in the thorough way that they need to be addressed. As an example of this, at the PME conference in 1998, Valero and Vithal (1998) criticised the mathematics education research community for its imposition of research methods from the relatively developed 'north' onto researchers and students from the relatively underdeveloped 'south' part of the world. They argue that methods developed in one cultural context are not necessarily appropriate or helpful in another cultural context, in terms of what is considered 'normal'.

To develop our field further, we clearly need to take on board the procedures and practices of anthropological and social psychological research, but we also need to recognise that we are working in the field of education, and more particularly in mathematics education. In general I believe that our research approaches must move to a more collaborative style, involving not only practitioners and researchers, but also to

include the learners and their peers as partners in the research process.

Just as we have found it necessary and beneficial to do research 'with' rather than 'on' teachers, so I believe we will need to develop ways of researching 'with' rather than 'on', learners, and their peers. Already qualitative methodologies have moved us closer to that goal, and if we are really serious about trying to improve our understanding of how learners deal with the conflicts and transitions in the cultural learning of mathematics then we have little choice but to engage fully with them in the inquiry process. This means as well as taking into account their cultural situation, we must also take into account ours. Just as we recognise the influences that their cultural contexts have on their learning, so we need to recognise the influences that our cultural contexts have on our learning, through our research.

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